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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte DIANE K. STEWART,
J. DAVID CASEY, JR., JOHN BEATY,
CHRISTIAN R. MUSIL, STEVEN BERGER,
SYBREN J. SIJBRANDIJ, and
JOAN WILLIAMS CASEY

Appeal 2009-002769
Application 10/758,966
Technology Center 1700

Decided: September 22, 2009

Before CATHERINE Q. TIMM, LINDA M. GAUDETTE, and
JEFFREY B. ROBERTSON, *Administrative Patent Judges*.

TIMM, *Administrative Patent Judge*.

DECISION ON APPEAL

I. STATEMENT OF THE CASE

Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's decision rejecting claims 1-12, 21, and 22. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM-IN-PART.

The invention relates to a process for repairing photolithography masks, which are made of patterned light absorbing material on a transparent substrate (Spec. ¶ [1000-01]). Opaque defects formed from excess pattern material can be repaired by removing the extra material using, for example, a focused beam of gallium ions (Spec. ¶ [1004]). Unfortunately, the ion beam implants ions into the substrate, which adversely affects the transmission of light through the substrate (Spec. ¶ [1004]). It was known in the art to remove a surface layer of the repaired substrate to improve light transmission, but this changes the thickness of the substrate, which in turn changes the phase of the transmitted light (Spec. ¶ [1005]). Appellants' process entails directing an electron beam, in the presence of a gas, at the repaired substrate at a beam energy and dose such that the thickness of the substrate is not substantially decreased, yet the substrate transmissivity is increased (Spec. ¶ [1007]). Claim 1 is illustrative of the subject matter on appeal:

1. A method of restoring the transparency of a quartz material having implanted gallium that reduces the transmission of the quartz material, comprising:

 directing a gas towards a gallium implanted portion of the quartz material; and

 directing an electron beam towards the gallium implanted portion of the quartz material, the electron dose of the electron beam being such that the thickness of the quartz material is substantially unchanged, and the transmission of the quartz material is substantially increased.

The Examiner maintains, and Appellants appeal:

- A. the rejection of claims 1-3, 6-8, and 10-12 under 35 U.S.C. § 102(e) as anticipated by Musil (US 2003/0047691 A1, pub. Mar. 13, 2003); and
- B. the rejection of claims 1-12, 21, and 22 under 35 U.S.C. §102(e) as anticipated by Stewart (US 2004/0151991 A1, pub. Aug. 4, 2004).

II. ANTICIPATION BY MUSIL

Issue

Have Appellants established that the Examiner reversibly erred in finding that Musil describes a method of restoring the transparency of a quartz material having implanted gallium including a step of directing an electron beam toward the gallium implanted portion at the electron dose required by claim 1?

We answer in the affirmative.

Findings of Fact

Musil describes using the conventional focused ion beam system (FIB) that uses a gallium ion beam to etch away defect material from the top of the substrate and recognizes that FIB implants gallium ions into the substrate causing a loss of transparency commonly referred to as “staining” (Musil, ¶¶ [0007], [0010]).

Musil solves the staining problem by using the FIB process to remove only a top portion of the excess material defect, leaving preferably about 20-40 nm of the material to be removed, and then using an electron beam process to etch away the remaining defect material (Musil, ¶¶ [0048-50]). Because gallium ions typically implant to a depth of between 20-40 nm, leaving a 20-40 nm thickness of defect material unetched by the ion beam results in little or no gallium implanted into the mask (Musil, ¶ [0048]).

Musil also explains that “[u]nlike FIB mask repair processes, the inventive process does not introduce any foreign atoms into the substrate and so avoids staining.” (Musil, ¶ [0033].)

The Examiner finds that “[t]o the extent that Ga ion implantation does occur, by using an electron beam to remove the last 20-40 nm of chromium [defect material], Musil would also be removing the implanted gallium ions.” (Ans. 4.)

Principles of Law

“To anticipate a claim, a prior art reference must disclose every limitation of the claimed invention, either explicitly or inherently.” *In re Schreiber*, 128 F.3d 1473, 1477 (Fed. Cir. 1997). In general, a limitation is inherent if it is the “natural result flowing from” the explicit disclosure of the prior art. *Schering Corp. v. Geneva Pharms., Inc.*, 339 F.3d 1373, 1379, (Fed. Cir. 2003). “Inherency . . . may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient.” *Mehl/Biophile Int'l Corp. v. Milgraum*, 192 F.3d 1362, 1365 (Fed. Cir. 1999)(quoting *In re Oelrich*, 666 F.2d 578, 581 (CCPA 1981)).

Analysis

Given that Musil describes halting the gallium ion beam etching so that little or no gallium ions are implanted in the substrate and then focusing the electron beam on the remaining defect material to remove it, we do not find the Examiner has provided sufficient evidence to show that gallium ions would necessarily be present and would be sufficiently treated by the electron dose such that the transmission of the substrate material would be substantially increased as required by claim 1. While it might be *possible*

under some circumstances that gallium ions would implant, one of ordinary skill in the art would operate Musil's process to avoid such implantation. Moreover, the Examiner has not established that the underlying substrate would be subjected to the dosage of electrons necessary to treat the gallium ions that might become implanted such that transmission of the quartz material is substantially increased.

Conclusion

Appellants have established that the Examiner reversibly erred in finding that Musil describes a method of restoring the transparency of a quartz material having implanted gallium including a step of directing an electron beam toward the gallium implanted portion at the electron dose required by claim 1.

III. ANTICIPATION BY STEWART

Issues

Have Appellants established that the Examiner reversibly erred in finding:

- (1) that Stewart describes an electron dose such that the thickness of the quartz material is "substantially unchanged" in accordance with claim 1?
- (2) that Stewart describes etching the substrate by less than 5 nm as required by claims 21 and 22?

We answer the first question in the negative and the second question in the affirmative.

Findings of Fact

The Specification does not define the degree of change that is encompassed by "substantially unchanged." (Spec., generally.) Rather, the Specification states that "[i]n *some embodiment*, the substrate thickness may

be decreased by an insubstantial amount, *preferably* less than 10 nm and more preferably less than 5 nm and most preferably less than 2 nm.” (Spec. ¶ [1049] (emphasis added)). This implies that “substantially unchanged” encompasses changes of more than 10 nm. The Specification also discusses a removal of 25 µm of quartz as a thickness of quartz that is “changed.” (Spec. ¶ [1031]).

Stewart describes a process using a gallium ion beam to remove an opaque defect, and then removing the resulting gallium-implanted quartz substrate layer by gas-assisted electron beam etching to restore transmission (Stewart, ¶ [0038]).

Principles of Law

Claim interpretation is a matter of law and will normally control the remainder of the decisional process. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561 (Fed. Cir. 1987). It is well settled that the word “substantially” has numerous ordinary meanings. It can be a term of approximation or a term of magnitude with meaning varying from “significantly” or “considerably” to “largely” or “essentially.” *Deering Precision Instruments L.L.C. v. Vector Distribution Sys. Inc.*, 347 F.3d 1314, 1321 (Fed. Cir. 2003). When “substantially” is used as a word of degree, one must look to the Specification to determine a standard for measuring that degree. *See Seattle Box Co. v. Indus. Crating & Packing, Inc.*, 731 F.2d 818, 826 (Fed. Cir. 1984) (“When a word of degree is used the district court must determine whether the patent’s specification provides some standard for measuring that degree.”).

Analysis

Appellants acknowledge that Stewart describes a method of restoring the transparency of a gallium-implanted quartz material, but contends that Stewart's mode of restoring transparency, i.e., by removing the gallium-implanted quartz, would substantially change the thickness of the layer and, therefore, would not leave the thickness "substantially unchanged" as required by claim 1, nor etch the substrate "by less than 5 nm" as required by claims 21 and 22.

In order to resolve the issue for claim 1, we must determine the legal scope of "substantially unchanged." The Specification does not provide a clear standard for measuring the degree of thickness change encompassed by "substantially unchanged." It appears that it encompasses changes of thickness of at least 10 nm, but is something less than 25 μ m (see FF above).

The gallium ion beam process implants gallium ions to a depth of about 20-40 nm (Musil, ¶ [0048]). Therefore, in the process of Stewart, about 20-40 nm of substrate material would be removed. This amount of removal is encompassed by the claim given the scope of the language "substantially unchanged."

Claims 21 and 22, however, require etching be limited to less than 5 nm. We agree with Appellants that the Examiner has failed to establish that Stewart describes a process in which etching is so limited.

Conclusion

Appellants have not established that the Examiner reversibly erred in finding that Stewart describes an electron dose such that the thickness of the quartz material is "substantially unchanged" in accordance with claim 1, but have established that the Examiner reversibly erred in finding that Stewart

describes etching the substrate by less than 5 nm as required by claims 21 and 22.

IV. DECISION

We sustain the rejection of claims 1-3, 6-8, and 10-12 as anticipated by Musil and the rejection of claims 1-12 as anticipated by Stewart. However, we do not sustain the rejection of claims 21 and 22 as anticipated by Stewart. Accordingly, the decision of the Examiner is affirmed-in-part.

V. TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(v).

AFFIRMED-IN-PART

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